

## CLAIMS

What is claimed is:

1. A method of operating a homogeneous-charge compression ignition (HCCI) engine, comprising:

mixing air, fuel and an acetylene-based component to form a combustion mixture; and

compressing said combustion mixture to induce auto-ignition of said combustion mixture, releasing energy and converting said combustion mixture to exhaust gas.

2. The method of claim 1 wherein said acetylene-based component consists essentially of acetylene.

3. The method of claim 1 wherein said acetylene-based component comprises acetylene and hydrogen.

4. The method of claim 1 wherein said combustion mixture further comprises engine exhaust.

5. The method of claim 1 further comprising producing said acetylene-based component using a plasma generator.

6. The method of claim 5 wherein said plasma generator uses a voltage and a frequency to produce said acetylene-based component.

7. The method of claim 1 further comprising producing said acetylene-based component with a thermal reactor.
8. The method of claim 1 further comprising drawing said combustion mixture into a cylinder of said HCCI engine.
9. The method of claim 1 wherein said step of mixing air, fuel and an acetylene-based component occurs within a cylinder of said HCCI engine.
10. The method of claim 1 wherein based on 100 parts by weight of said fuel, said acetylene-based component constitutes up to 20 parts by weight of said fuel.
11. The method of claim 10 wherein said acetylene-based component constitutes at least 2 parts by weight of said fuel.
12. The method of claim 1 further comprising exhausting said exhaust gas.

13. A method of operating a homogeneous-charge compression ignition (HCCI) engine between a high load condition and a low load condition, comprising:

controlling a supply of an acetylene-based component based on a load of said engine;

controlling a supply of a fuel based on said load of said engine;

mixing air, said fuel and said acetylene-based component to form a combustion mixture; and

compressing said combustion mixture to induce auto-ignition of said combustion mixture and convert said combustion mixture to exhaust gas.

14. The method of claim 13 wherein said acetylene-based component consists essentially of acetylene.

15. The method of claim 13 wherein said acetylene-based component comprises acetylene and hydrogen.

16. The method of claim 13 wherein said combustion mixture further comprises engine exhaust.

17. The method of claim 13, wherein said step of controlling a supply of said acetylene-based component comprises maintaining a consistent supply regardless of said load.

18. The method of claim 13 wherein said step of controlling a supply of said acetylene-based component comprises terminating said supply when said load is high.

19. The method of claim 13 wherein said step of controlling a supply of said acetylene-based component comprises increasing said supply as said load decreases.

20. The method of claim 13 wherein said step of controlling a mixture amount of said fuel comprises reducing said mixture amount as said load decreases.

21. The method of claim 13 further comprising producing said acetylene-based component using a plasma generator.

22. The method of claim 21 wherein said plasma generator uses an a voltage and a frequency to produce said acetylene-based component.

23. The method of claim 13 further comprising producing said acetylene-based component using a thermal reactor.

24. The method of claim 13 further comprising drawing said combustion mixture into a cylinder of said HCCI engine.

25. The method of claim 13 wherein said step of mixing air, fuel and said acetylene-based component occurs within a cylinder of said HCCI engine.

26. The method of claim 13 further comprising injecting an amount said acetylene-based component within a range of up to 20 weight % of said fuel.

27. A vehicle driven by a homogeneous-charge compression ignition (HCCI) engine, comprising:

a fuel supply that supplies a hydrocarbon fuel in a first amount;

an acetylene supply that supplies an acetylene-based component in a second amount; and

a cylinder having a piston reciprocally driven therein, said cylinder receiving a combustion mixture including a third amount of air, said first amount of hydrocarbon fuel and said second amount of said acetylene-based component, wherein said piston compresses said combustion mixture to induce auto-ignition of said combustion mixture.

28. The vehicle of claim 27 wherein said acetylene-based component consists essentially of acetylene.

29. The vehicle of claim 27 wherein said acetylene-based component comprises acetylene and hydrogen.

30. The vehicle of claim 27 wherein said combustion mixture further comprises engine exhaust.

31. The vehicle of claim 27 further comprising an inlet valve movable between an open position and a closed position, wherein when in said open position said inlet valve enables a flow of said combustion mixture into said cylinder.

32. The vehicle of claim 27 further comprising:

a fuel injector that selectively injects said first amount of said hydrocarbon fuel into said cylinder;

an acetylene injector that injects said second amount of said acetylene-based component into said cylinder; and

an inlet valve movable between an open position and a closed position, wherein when in said open position said inlet valve enables a flow of said third amount of said air into said cylinder to mix with said hydrocarbon fuel and said acetylene-based component to produce said combustion mixture.

33. The vehicle of claim 27 wherein said acetylene supply is a plasma generator that converts a portion of said hydrocarbon fuel to produce said second amount of said acetylene-based component.

34. The vehicle of claim 27 wherein said second amount of said acetylene-based component is up to 20 weight % of said fuel.

35. The vehicle of claim 27, wherein said second amount of said acetylene-based component varies based on a load of said HCCI engine.

36. The vehicle of claim 27, wherein said second amount of said acetylene-based component remains constant regardless of a load of said HCCI engine.